"Deciding in a Complex Environment": Human Performance Modeling of Dislocated Organizations

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In this paper the method "Organizational Behaviour Representation" (OBR) will be presented including its basic concepts and the resulting software-demonstrator. The study's main objective covers the principles needed to build effective reachback organizations. Dislocated command and control structures are necessary to meet present and future challenges of military organizations.

Improved communication and collaboration tools enable this kind of virtual teamwork and offer advantages such as e.g. a small "footprint", flexible and agile staffing of reachback and deployed units, additional "ad hoc" expertise or industrial supplements.

Often, there are performance problems in virtual teamwork due to misunderstandings in collaboration. OBR models mainly social and cognitive processes grounded in human factors research which are coupled tightly to organizational performance. For example, organizational performance often decreases because of the loss of shared situational awareness of forward and reachback elements or deficiencies in personnel resources. On the other hand, good practice, well-routined staff work and optimized team preparation through personnel training or experience in military missions support and reinforce working processes which lead to higher performance indicators.

In our organizational model we consider the complex interconnections of many social and personnel parameters. A System Dynamics based model has been designed that implements important effects in dislocated organizations, known from human factors research and military experience. One way to use this model is to implement it in a "think tool" for military personnel that has to design or tackle with dislocated c2 (Command & Control) structures. The tool can help military leaders to identify measures they can take to improve the performance of dislocated organizations. A demonstrator for such a software tool has been developed within the OBR study.

The study investigates the application of the OBR method, evaluating the structure of dislocated organizations and further its implications for training and development in the pre-deployment phase.

1.0 MILITARY CONTEXT AND RESULTS OF THE STUDY

The German Bundeswehr faces foreign deployment on a big scale. One major objective is to maximize the efficiency of operations and HQ (Headquarter) -concepts with an "optimal" personnel arrangement. This includes the basic principle "As many people in the operational environment as necessary, as many in the home base as possible".

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14. ABSTRACT

In this paper the method Organizational Behaviour Representation (OBR) will be presented including its basic concepts and the resulting software-demonstrator. The studys main objective covers the principles needed to build effective reachback organizations. Dislocated command and control structures are necessary to meet present and future challenges of military organizations. Improved communication and collaboration tools enable this kind of virtual teamwork and offer advantages such as e.g. a small footprint, flexible and agile staffing of reachback and deployed units, additional ad hoc expertise or industrial supplements. Often, there are performance problems in virtual teamwork due to misunderstandings in collaboration. OBR models mainly social and cognitive processes grounded in human factors research which are coupled tightly to organizational performance. For example, organizational performance often decreases because of the loss of shared situational awareness of forward and reachback elements or deficiencies in personnel resources. On the other hand, good practice, well-routined staff work and optimized team preparation through personnel training or experience in military missions support and reinforce working processes which lead to higher performance indicators.

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Therefore this study wants to answer two questions:

- How can concepts of dislocated organizations fulfill these new military requirements?
- What is the influence of reachback to the performance of organizations?

In the process of finding appropriate answers the study's research uses the OBR method to analyze and model the structures and processes of existing and future HQ-Concepts. In previous work we showed, that it is possible to model organizational behavior with the OBR method.

For the simulation of dislocated organizations a demonstrator has been developed. If used for simulation of user-defined organizational models it can show important effects relevant to organizational performance. Therefore the use of the demonstrator can help to identifies risks in the organizational structure and to find options for improvement. The "tool" does not substitute the decision making process performed by military leaders, but may support it.

According to FINABEL´s (2008)[1] definition, reachback can be seen as "the process of obtaining mission essential expertise and information, in a timely manner, amongst and between deployed and non-deployed elements or organizations, in order to improve operational effectiveness". Therefore reachback means to split up the c2 structure and its process physically into two organizational units that with a more or less intensive task-dependent cooperation.

Virtual teamwork often fails due to non-effective or even missing collaboration. Basically the OBR model of social and cognitive processes is founded in Human Factors research. In particular the theoretical background is situated in the topic of organizational performance. For instance, organizational performance often decreases if shared situational awareness of reachback elements will be reduced or deficiencies in personnel resources appear. In contrast processes which increase organizational performance can be reinforced and supported by good practice, well-routined staff and optimized team preparation through personnel training or experience in military operations. To analyze and plan military staffing, Human Factors variables have to be identified and modeled to get a more holistic and realistic picture of the organizational behavior.

2.0 MODELING DISLOCATED ORGANIZATION

The concept and implementation of the OBR demonstrator was lead by three key goals:

- It should be possible to model, edit and simulate a user defined organization, not only one or several fixed "hardwired" organizations.
- The modeling process should easily enable the user to model dislocated organizational structures.
- The user should not be hampered by the complexity of the model and simulation more than necessary.

The "User Organizational Model"

The "User Organizational Model" is the part of the model where the user of the software defines the (existing or not existing) organizational structure she/he wants to design.

[1] FINABEL (2008) Finabel (2008). R23R - Reach Back: Enhancing the Command and Control of multinational operations through the use of reach back capabilities.
Finabel is a European organization which has as its purpose to promote interoperability and cooperation in the army area. The organization was founded in 1953. The name Finabel was created as an acronym of the initial letter of the initial member states - France, Italy, the Netherlands, Belgium, and Luxembourg. It became FINABEL, when Germany (Allemange) joined in 1956.

We defined a so-called Metamodel that describes the rules for building User Organizational Models, e.g., which "building blocks" the Model may be built from and how they may be connected to each other. A user friendly editor has been implemented that allows designing a User Organizational Model that follows these rules.

The basic elements ("building blocks") of the User Model are the "Functional Element " (FE) and the "Cooperation Space" (CS). An FE represents a group of people that is treated by the model as homogeneous. That means that the different persons in that group are described by one single parameter set and not by different parameter sets per person. These people know each other, meet each other regularly and work on the same subject. For example a military "cell" within the staff might be modeled as an FE. A FE may contain from 1 to X persons, where X is normally about 3-6.

Figure 1 shows an example for a four person FE named "A2 Intel Assessment Cell FWD".

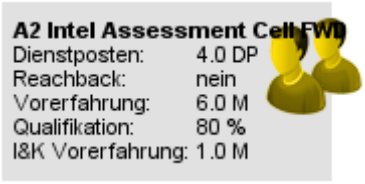

Figure 1: Example for a "Functional Element" (FE).

The key attribute of our Metamodel for the "User Organizational Models" is that is does not represent an organizational structure diagram that shows the organization units and their hierarchical status. These diagrams are not useful to consider the working processes within an organization. But the working processes ("who works with whom on which subject") are a crucial aspect for performance within dislocated organizations.

Therefore, the core element of the Metamodel for building the "User Organizational Model" is the "Cooperation Space" (CS). A CS represents an (heterogeneous) working group that works regularly on one specific task. Several different "Functional Elements" may contribute to different degrees to the work within the CS.

A CS may be a group of people working together to produce a certain document or a document update.

Figure 2 shows an example of a "Cooperation Space" named "AOD update" that requires a work performance equivalent of six persons during the period it is active.

Figure 2: Example for a "Cooperation Space" (CS).

Figure 3 shows an example of two Functional Elements connected to a "Cooperation Space". The connection is labeled by a number that gives the work performance equivalent of the contribution. In this example the Intel Assessment Cell contributes to the Intel Assessment with an average of 2 persons.

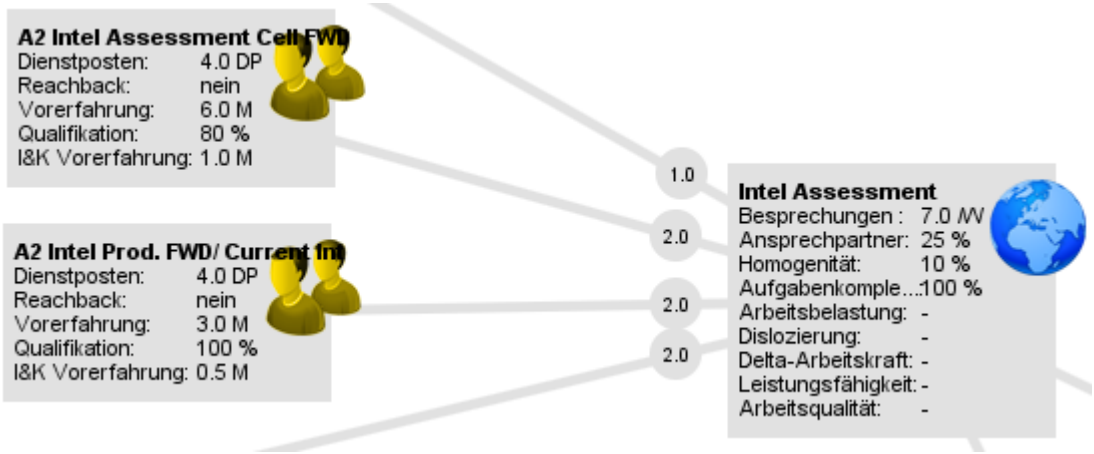

Figure 3: Example for "Functional Elements" connected to a "Cooperation Space" (Section).

A complete "User Organization Model" normally contains several "Cooperation Spaces". The organizational performance can be defined as the sum of the performance values of several "Cooperation Spaces". As the "Cooperation Spaces" may be of different importance for the overall performance of an organization, the organizational performance is a weighted sum of the performance values of the "Cooperation Spaces".

Figure 4 shows an example for the "Organizational Performance" element to which the Intel Assessment CS contributes with 30%[2].

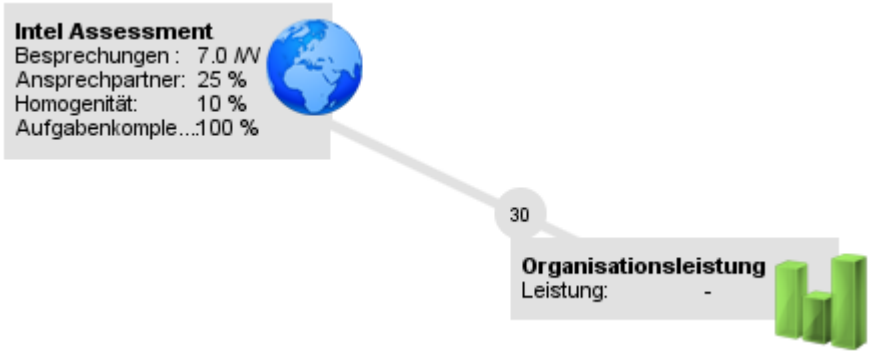

Figure 4: Example for a "Cooperation Space" contributing to an "Organizational Performance" element.

In Figure 5 you can see the example of a small but complete "User Organization Model".

[2] Other "Cooperation Spaces" not shown here contribute the remaining 70%.

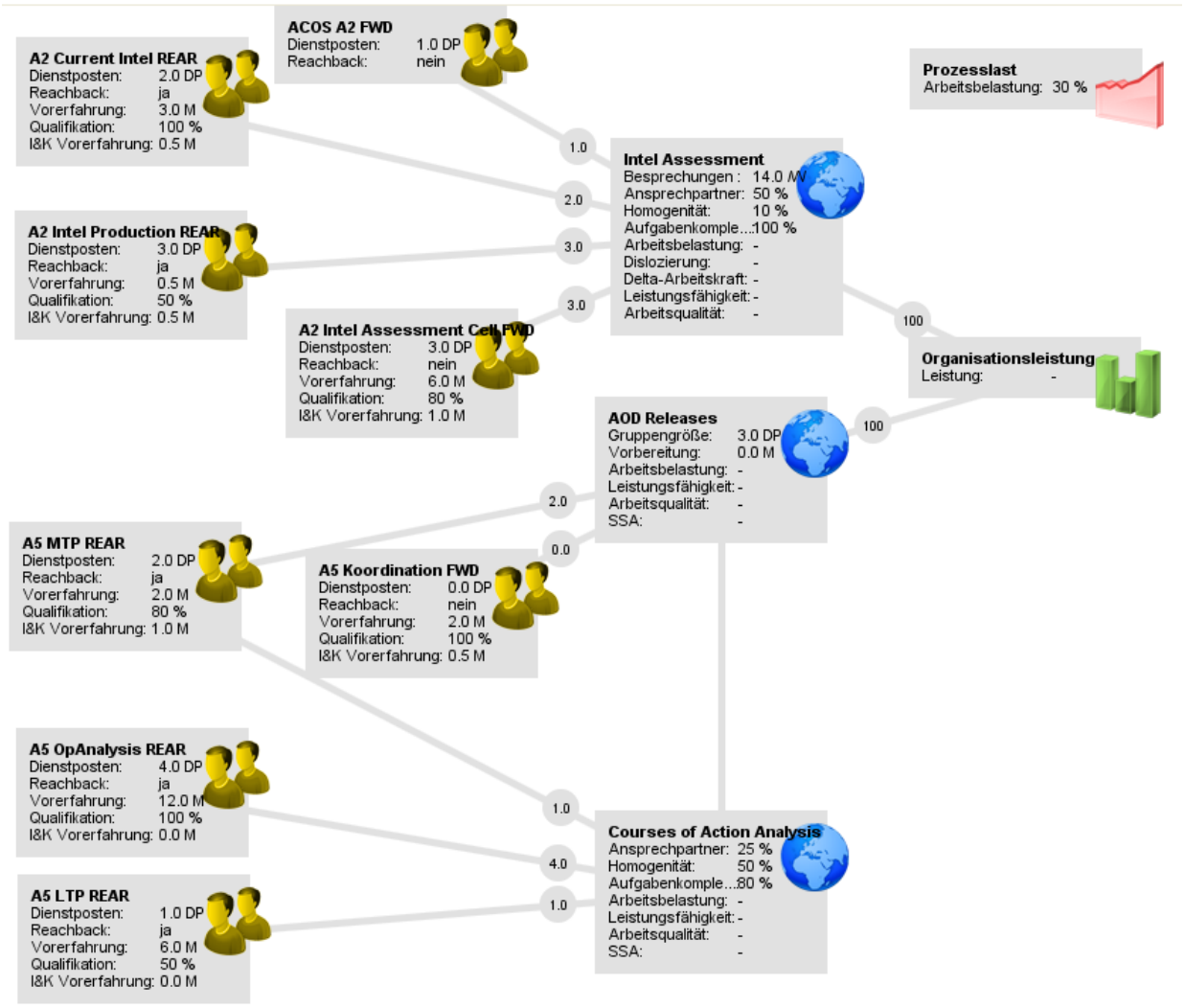

Figure 5: Example for a "User Organization Model".

The Underlying Human Factors Model

The "Functional Element" is a rather simple building block, only containing some attributes like, e.g. size and working experience. The "Cooperation Space" in contrast is a very complex building block, because there are numerous interdependencies between various variables of the processes in a working group. They are represented in a rather complicated underlying System Dynamics based model.

In modeling organizational dynamics within a CS, the basic concepts are feedback loops. Increasing and decreasing variables in the system forms loops of reinforcement or balance. For example, if the quality of the work increases and therefore the number of points of friction decrease, the working group will use less of the time available for coordination. This leads to more time for "productive" work, which may further contribute to good quality of work.

There are two kinds of loops: reinforcing and balancing loops. Reinforcing loops are processes in which an increase or decrease leads to an increase or decrease in the subsequent measurement. Balancing loops behave like a balance, that means, that the increase or decrease of certain parameters lead to the opposite.

The complexity of this System Dynamics based model underlying each "Cooperation Space" is hidden from the user. To get an impression of this model, Figure 6 shows a part of this model - covering about a third. Figure 6 also shows a feedback loop concerning performance, coordination and process quality.

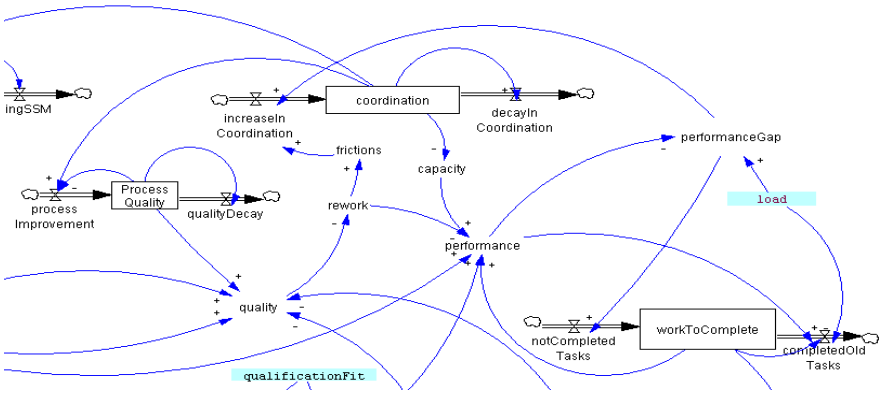

Figure 6: Part of Causal loop diagram of the working process in a "Coordination Space".

3.0 SIMULATING ORGANIZATIONAL MODELS

One of the main objectives covered by the simulation of the user organizational model is to show important effects concerning the performance of an organization in order to help to improve and maximize the efficiency of operations with an appropriate personnel arrangement.

After the user has built his own "User Organization Model", he can enter all the parameters for the elements (especially "Functional Elements" and "Cooperation Spaces") using the Model Editor of the OBR-Tool.

After that, it is possible to start a simulation run and watch output variables like the performance of each "Cooperation Space". Changing conditions, e.g. different structure or personal resources, can be simulated after adapting the appropriate parameters. As an example, figure 7 shows the performance of three "Cooperation Spaces". On the left side you see the first run, on the right side some improvements have been made according structure, dislocation and pre-deployment training resulting in an improved performance of one of the "Cooperation Spaces".

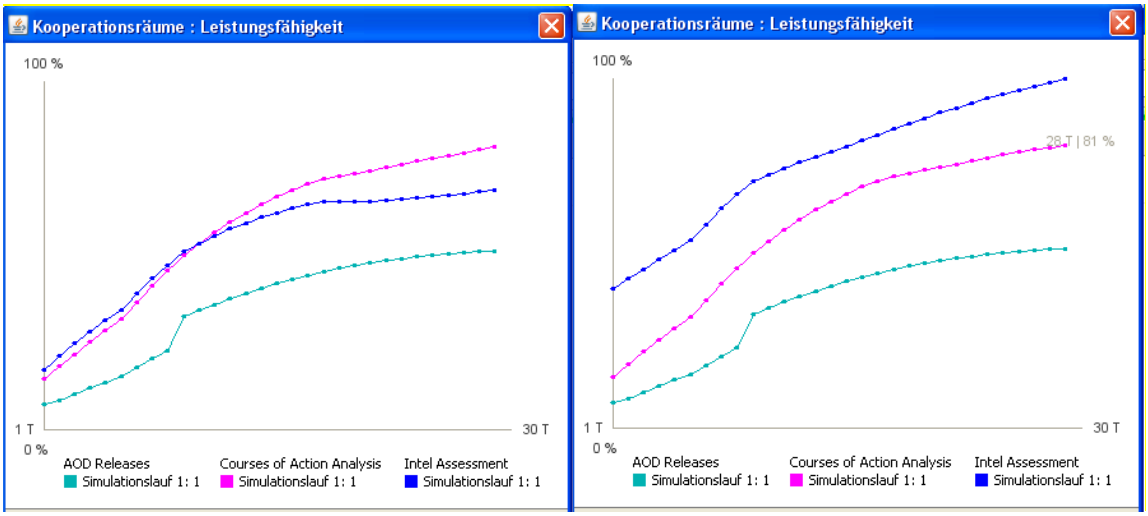

Figure 7: Performance of three "Cooperation Spaces" in two different simulation runs.

The x axis represents time and covers the first 30 days of the mission (in this example). For this application in the area of military reachback operations we choose one day per time step as simulation time period.

4.0 IMPLICATIONS FOR DISLOCATED ORGANIZATIONS

The final version of the OBR simulation model can be used to build up any type of reachback organization and can be easily executed. We defined several output parameters for our performance measurement, as for example:

- Current workload,
- Process quality, and
- Coordination effort.

These parameters and selected relationships between our psychological and social parameters were examined in two case studies. Both studies took place in the field of exercises and conceptual experimentation of the German Military Armed Forces. First we investigated the relevance of our parameters by observing and interviewing team members of dislocated planning processes of a military staff. Second OBR was used in its "thinking tool" functionality to model different organizational designs of "As-Is"/"To-Be" conditions in Joint Fire Support Operations.

The OBR-Tool contains a considerable amount of expert knowledge concerning aspects and difficulties of dislocated staff work. For personnel that are less experienced in this area, modeling and simulating with the OBR-Tool can help to identify problems in a dislocated staff structure and to get ideas for measures that could be taken to improve the performance. Thus the OBR-Tool can be used as a "thinking tool" that helps less experienced decision makers to consider Human Factors when planning dislocated staff work.

Additionally the OBR-Tool can be used as a training tool for military leaders to sensitize them to important aspects of organizational work.

An important aspect of this are the formal an informal relationships among the staff members. These relationships are crucial for the organizational performance. Visualization of these complex interrelation between various main tasks in military staff work could support the decision making process in operational planning on a higher level.

Another important aspect is to look at the question "Who is working with whom?" instead of "Who is in which organization unit?". Thus modeling "Cooperation Spaces" (e.g. working groups that work on a common document) and contributing "Functional Elements" forces the modeler to consider this point of view.

With the OBR model and simulation system it should be possible to simulate the organizational performance under different conditions. Human resource planning and development should be connected to organizational structure or tasks. We achieve the first steps in defining performance measures for "virtual military organizations".